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Preserving and reusing architectural design decisions

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Chapter 6

Busting Software Architecture Beliefs

“There are no rules of architecture for a castle in the clouds.”

- Gilbert K. Chesterton

This chapter is based on: Jan Salvador van der Ven and Jan Bosch. “Busting Software Architecture Beliefs: A Survey on Success Factors in Architecture Decision Making”. In: *42th Euromicro Conference on Software Engineering and Advanced Applications (SEAA)*. Aug. 2016, pp. 42–49.

Abstract

As software development changes, also the myths and beliefs around it come and go. In different communities, different beliefs are kept, usually strengthened by success or failure stories. In this research, we study the beliefs surrounding software architecture. The beliefs range from the amount of effort needed for architecture documentation, to the size of the team or the persons responsible for making the architectural decisions. Most beliefs are based on the idea that the outcome of the project is highly dependent on the methods used during the design and development of software. We conducted a survey with 39 architects where we evaluated 54 architectural decisions. In this survey, we assessed the way in which decisions were made, the success factors of the decisions, as well as the properties of the projects. We conduct statistical analysis in order to validate or invalidate some of the beliefs that currently exist in software development. We conclude that for most of the beliefs, no statistical evidence can be found, making these beliefs folklore for the tales, instead of useful guidelines for predicting projects success or failure.

6.1 Introduction

In the last decade, the creation of software systems has changed rapidly. Traditionally, long-lasting waterfall projects (>two years) were standard, while now rapid development (<three months) with fast changing requirements is becoming the norm for creating software products [25]. In both cases, the architecture of the system has to be taken into account, although when, how and who is responsible differs significantly [184]. Formerly, experienced architects created models and documentation for the system beforehand, so the development team had a solid base of decisions to build on. Nowadays, at more agile projects, the architectural decisions are made JIT (Just In Time) by the development team itself, often assisted

by a participating architect. Alternatives for heavy template based documentation [42], like wikis or photos, are used to document the decisions [184]. This led to a change in responsibilities and in the role of the architect. The responsibilities for the architectural decision process shift from the formal architect [62] to the development team. The architect gets more of an advisory servant role within the project, often participating in the development team as a designer or developer.

However, both from the traditional architecture community as well as from the agile community beliefs exist concerning software architecture and the decision-making process. In order to validate the accuracy of these beliefs, we have conducted a survey with architects that make architecture decisions on a daily basis. In the survey, we analyzed three main aspects: what was the success of the decision? What were the properties of the decision based on the Triple-A Framework [184]. As a last aspect, the additional project and decision properties were questioned. In this survey, 39 participants provided details about a total of 54 architectural decisions. The data provided by the participant forms the basis for our analysis.

Software architecture is a challenging research field. As projects are difficult to compare, research is sometimes based on anecdotal evidence that comes from individual projects or persons. This increases the likelihood of the emergence of unfounded beliefs. This is reinforced by the architectural practice, where the success of projects is highly related to the image of the companies involved and successful systems are, sometimes unfoundedly, attributed to successful architectural decisions. Finally, in industry there are several movements, including programming paradigms, programming languages or development methods that lead to specific views on building software with occasional religious overtones. As a consequence, in our field of research it is difficult to distinguish between opinions and facts.

Our research focuses on software architecture. We have collected beliefs and checked their validity by conducting a survey with software architects. We have used questions on three distinct topics:

- Questions about the experience of the person and the characteristics of the project
- Questions about the way in which architectural decisions were made (based on the Triple-A Framework).
- Questions on the success of the project

The answers to these questions were used to validate or falsify the beliefs about software architecture decision making.

The contribution of this research is threefold. First, we provide an overview of the primary beliefs that exist currently around software architecture. Second, we show which of these beliefs are and which are not confirmed by our empirical data, and we provide specific details about what aspects of these beliefs can be validated. For the unfounded beliefs, we finally describe the impact for the architecture community of having these unfounded beliefs.

This chapter is organized as follows. First, the background for the beliefs, the Triple-A Framework and the project properties is given. Then the experimental

setup is described. The results are discussed in the sequential section, followed by a reflection on the results. This chapter ends with related work and some concluding words.

6.2 Background

6.2.1 Triple-A Framework

Our previous work describes the Triple-A Framework (Agile Architecture Axes Framework) [184] for characterizing the architectural decision process. In our current research, we use the Triple-A Framework as one of the aspects of an architectural decision, in order to classify the decisions and relate them to the beliefs. The Triple-A Framework consists of three orthogonal axes:

- **Periodicity (When).** The "decision loop" [23] describes how decisions lead to new decisions, based on the alternatives chosen. However, what is rarely described is the periodicity of the decision. What is the length between the actual decision, and the resulting validation of this decision to the quality attributes that the system needs to comply to?
- **The Architect (Who).** In architectural knowledge literature [62], the architect is referred to as the person responsible for the architecture, or the person who makes the architectural decisions. However, who this person is, what role the person has in the project or organization, and what skills this person needs, is very important. And the effects of these skills on the results of the project are seldom written about.
- **Artifacts (How).** As an abstraction of all things that are created around the architecture development process, often the term artifact is used. Examples of artifacts are documents (e.g. SAD), models (e.g. UML), or source code.

The periodicity axis is split this axis into two different parts: the time between the arising of the problem and the actual decision, and the time it took to validate that the decision was the right one. This resulted in four axes for the Triple-A Framework that we used in our survey as shown in Appendix A. The questions about the position on the Triple-A Framework were multiple-choice questions.

6.2.2 Success Factors of a Decision

The effect of a decision on the project success can be defined by different criteria [196]. Agarwal [3] describes three main measures for success: cost, time and quality of the product. We have distilled four success factors from this: the Return on Investment as a representation of the cost. The time measure is split into two factors: the amount of effort needed for the project, and the development speed. The last success factor is the quality of the product. In addition to this, the results of the decision on four important quality attributes for software systems were asked: performance, maintainability, security and usability. So, in total eight success factors were asked for, as shown in Appendix A. For all of these factors, a Likert scale

with values 1-5 was used, where 1 meant strongly disagree and 5 meant strongly agree.

6.2.3 Project and Person Characteristics

In order to validate the beliefs, characteristics of the decision maker and the project needed to be measured. Therefore, the following project properties have been included in the questionnaire:

- **Experience of the respondent.** To be able to compare the experience of the respondents, two questions were included: experience in architecting, and experience as developer.
- **Duration of the project.** This parameter concerns the duration of the project.
- **Project size.** In order to get an idea about the size of the project, the project team size and the number of project partners was questioned. Additionally, we asked about the size of the project in line-of-code and person-months, but that was unknown by a lot of respondents to this was left out in the analysis.

The complete list of Characteristics is included in Appendix A. All of the answers except for the number of partners were multiple-choice questions where ranges could be selected. In that one, a number could be entered for the number of partners involved in the project.

6.2.4 Beliefs

We have looked for several stubbornly beliefs around software architecture. In this research, we focus on the beliefs that relate positions on the Triple-A Framework to project success. These beliefs are generally in the form that the success of a project is depending on what the team / person does. The latter is reflected in the position on the Triple-A Framework.

- **B1. Making architectural decisions quicker leads to a worse quality product.** Well-designed architectures are based on the most important architectural decisions [100, 201]. This implies the process for making these decisions [183] should be well thought out. The underlying belief for these important decisions is that the decision speed is of less importance compared to the decision outcome. Hence, it is expected that decisions that are made hastier create projects of worse quality compared to projects based on decisions that took more time.
- **B2. Making and validating architectural decisions quicker increases the development speed and RoI of the project.** Another belief affecting the decision making speed is the belief that when making decisions quicker, the development speed can be increased without sacrificing the quality (as checked in B1), if the decisions are also validated quickly. Especially the lean startup community [136, 156] stresses the importance of validating assumptions as quickly as possible with customers. Architectural decisions can have a huge

impact on the system and the business. Validating these decisions is considered essential, especially for learning about the business (RoI), and to increase development speed by knowing what does (not) work early on in the project.

- **B3. People that code the system should design the system to achieve speed in development.** The agile community stresses that one should avoid ivory-tower architects [118] making the important decisions for projects. The assumption is that they don't have feeling with the code, and that nice looking designs are favored over practical solutions. The belief implies that the development speed decreases as more time is spent on the architecture design, while the architecture is harder to implement.
- **B4. Decisions made by higher ranked architects have a higher RoI and better Quality.** The roles people have in organizations vary. As we have shown in our previous work [184], it is possible to rank the decision-maker based on the role he or she has in the company or project. Belief B4 implies that when higher-ranked architects make decisions, it leads to better quality products that have a higher RoI.
- **B5. Less architectural documentation decreases effort needed and speeds up development.** Typically, more extensive architecture documentation takes more time to write and more time to review [76]. Also, it is harder to comply to the architecture when it is contained in extensive documentation. Hence, the tradeoff to make just enough documentation is very difficult to make [50, 147]. However, the belief that development speed increases and the effort spend on the project decreases when limiting used architectural documentation is generally held.
- **B6. Less architectural documentation decreases project quality.** On the other side, there is the belief that better documentation increases the quality of the system as it is better thought-of and decisions made previously are easier to reproduce. This belief is especially often phrased when weighting short-term benefits (quicker decision process) against long-term benefits (quality) [14]. As knowledge vaporization increases when decisions are not documented [100], it is expected that the quality of the system declines when documentation is omitted.

All of the described beliefs can be shown as a relationship between positions on the Triple-A Framework and imply specific success criteria for the belief. In the next section, we describe the experimental setup of this research.

6.3 Experimental Setup

6.3.1 Survey

In order to validate or invalidate the beliefs stated in the previous section, we conducted a survey. The survey consisted of three main parts, as described in the previous section:

- The **context of the project**, data of the respondent like background, experiences, and current role, as well as project properties like the type of project, the size and running time.
- The **success factors** of the decision, as described in the previous section.
- Finally, in the last part **the position of the decision on the Triple-A Framework** was determined to be able to classify and compare the different architectural decisions.

Appendix A shows all the relevant questions of the questionnaire. The respondents could fill in the decision details for one or two decisions.

The invitation for the survey was sent to potential participants from a personal email address of one of the researchers. In addition to the survey questions, we ended the survey with a question if the respondent knew more people who would be qualified and interested in filling in the survey. The survey was sent to those people too. The invitations were selected from the connections of the researchers, based on the experience of the connections.

In total 25 emails were sent to Dutch speaking architects from the Netherlands, and 18 to English speaking architects in the Netherlands, Sweden and the USA. Some of the invited architects forwarded the invitation to other architects in the company that were better suited for the questionnaire. In addition, some of the invited architects responded to the invitation that they were not classified to fill in this kind of survey, or that their company would not like them to provide details about the architecture of their systems. As a result, a total of 39 respondents provided data about 54 architectural decisions.

6.3.2 Data Preparation

In order to be able to do statistical analysis, the data from the survey was pre-processed for analysis in R. The survey results were exported to a CSV that could be used as a data source in R. All the data was transformed to floats between 0 and 1. The position on the Triple-A Framework was codified. The different options per axis [184] were mapped on a number between 0 and 1, where the distances between the steps were alike. The success factors were already numbered (as they were multiple-choice questions with only one option possible), they were normalized to numbers between 0 and 1. The project and architect properties were also codified and normalized between 0 and 1. The result was a large data-matrix that was used as the basis for our analysis.

6.3.3 Analysis Methodology

In order to validate the beliefs, we have sliced the data set into different groups. Based on the belief at hand, we use one of the axes, properties or success factors to split the data set. Then, we analyze what the differences in these data sets are by conducting a Wilcoxon test [198], comparing the created two groups on the specific property we are investigating. Only results that had a $p < 0.05$ are mentioned as valid results.

6.4 Results

This section describes the results of the survey. First, the some general observations on the data are given. Then, the data about the beliefs from in Section 6.2.4 are analyzed. This section ends with some addition observations on the survey based on correlations that were found but did not connect to the assessed beliefs.

6.4.1 Characteristics of the Projects and Participants

Details of 39 architects and projects are shown in Figure 6.1. Generally, the respondents were experienced architects, both in development experience as well as in architecting experience. Most of the projects lasted less than 6 years. The team sizes of most projects were between 4-30 project members. A few (4) projects were very large (>100 project members).

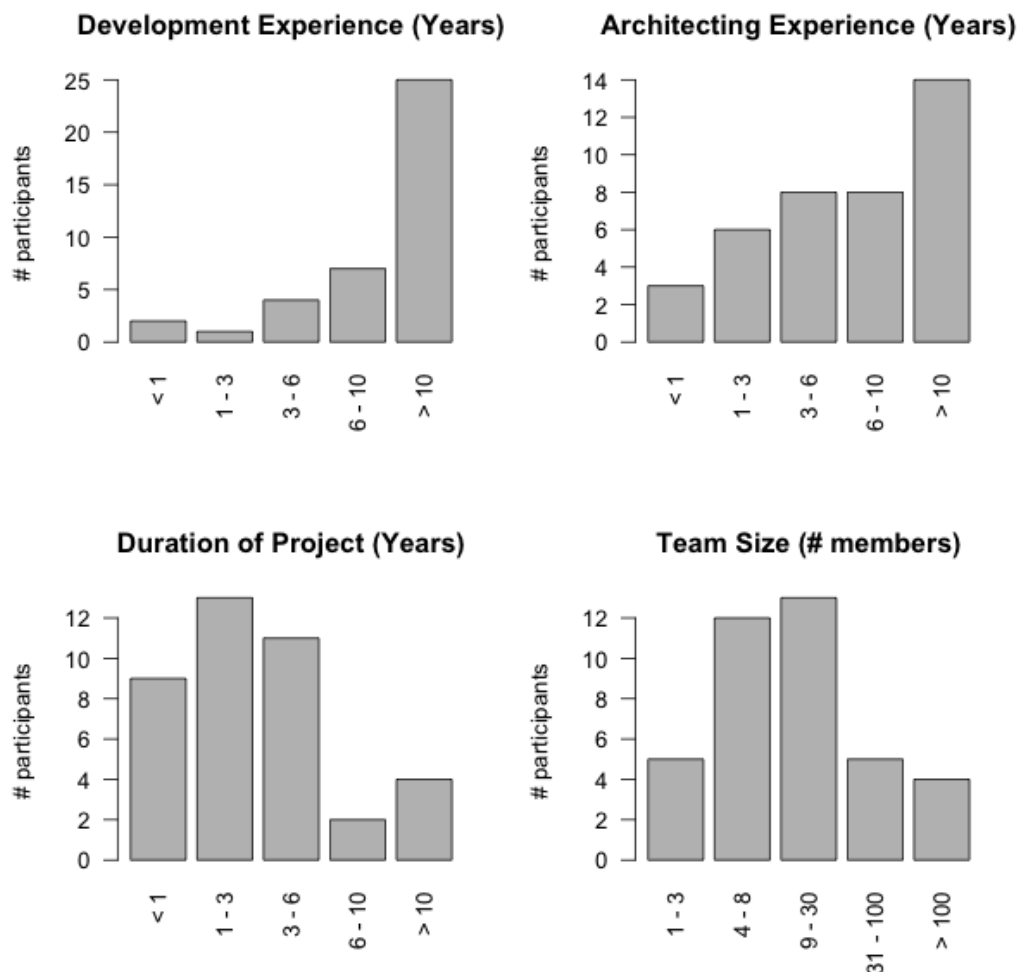


FIGURE 6.1: Project and Architect Properties.

6.4.2 Assessing Beliefs

In this subsection, we describe all the beliefs that were identified previously in this chapter, and describe the survey data around it in order to validate or invalidate the belief.

- **B1. Making architectural decisions quicker leads to a worse quality product.** To investigate this belief we have split the data in two groups based on the speed of making decisions. The A1 Axis is used to split the dataset in decisions that are made within one week (marked as quick decisions) and a group of decisions that took more than one week to complete. We run the Wilcoxon test on these groups to see if the quality of the product differed significantly in one of these groups. None of the quality attributes provided any significant correlation. Therefore, we can conclude that our data cannot confirm this belief.
- **B2. Making and validating architectural decisions quicker increases the development speed and RoI of the project.** For assessing this belief, the data was again split into groups to identify differences between fast and slow decision-making. Again the split was placed on periodicity of one week. We checked the two groups for the specific success factors: S1 (Return on Investment) and S3 (development speed). As with the first belief, no significant correlation could be found. Hence, belief B2 could not be confirmed by the data in this research, so the speed at which the decisions are made does not affect the development speed or the RoI.
- **B3. People that code the system should design the system to achieve speed in development.** For this belief, the data was split in two groups by the A3 axis (who makes the decision). One groups consisted of projects where the development team was responsible for the decision-making, in the other group, others in the organization were responsible (e.g. application architects, enterprise architects, management). We checked if there was a significant correlation between the groups and the speed of development (S3). No significant correlation was found, so, also this belief was unfounded by our data.
- **B4. Decisions made by higher ranked architects have a higher RoI and better Quality.**
 - B4.1 Affecting the same axis (A3) as B3, this belief is also centered on the persons making the decisions. The groups were made based on the roles of the decision makers. The same grouping was used as with B3. The groups were checked for RoI (S1) and general quality (S4). Again, no significant correlations were found.
 - B4.2 In order to further analyze this belief, we also looked for relationships based on the experience of the architect instead of the role in the organization. Here, one group consisted of people with less than 6 years of architecting experience while the other group consisted of people with more architecting experience. We found a significant correlation

TABLE 6.1: Overview of Conclusions on Beliefs

Belief	Properties	P	Conclusion
B1	A1 - S4	> 0.05	No evidence found
B2	A1 & A2 - S1 & S3	> 0.05	No evidence found
B3	A3 - S3	> 0.05	No evidence found
B4.1	A3 - S1 & S4	> 0.05	No evidence found
B4.2	arch_exp - S1	0.038	Confirmed
B5.1	A4 - S2	> 0.05	No evidence found
B5.2	A4 - S3	0.041	Confirmed
B6	A4 - S4	> 0.05	No evidence found

between the experience and the RoI (S1, $p=0.038$), but not to quality of the product (S4). Hence, projects where more experienced architects made the decisions got better RoI than other projects.

- **B5. Less architectural documentation decreases effort needed and speeds up development.**
 - B5.1 For this belief, we looked at the forth axis, how the architecture was documented. We split the data in one group that does document the architectural decisions and the other group that do not explicitly document them (but rely on face-to-face communication, notes or photos of white-boards). We checked the difference of these groups against the success factors that involved the effort needed (S2), but no correlation was found.
 - B5.2 Then, the same group was run against the other success factor, the development speed of projects (S3). A correlation was found: less documentation correlates with projects with higher development speed (S3, $p=0.041$).
- **B6. Less architectural documentation decreases project quality.** On the same axis (A4), the amount of documentation was checked against the quality of the product (S4). Here, we used the same distribution as in the previous belief by splitting the data in one that uses documentation and one that does not use it explicitly. Between these groups, no significant quality differences were detected. So, this belief also found no ground in our data.

In Table 6.1, the results of the analysis of the beliefs are summarized. The first column states the belief, the second one the properties of the decision that were used to do the assessments. The 'p' Column describes the p-values for confirming the correlations. The last column states the conclusion of the belief.

6.4.3 Additional Observations

In addition to the evaluated beliefs and related parameters, we also checked the data for correlations that we did not expect. From this, we saw that the two positions on the when-axis of the Triple-A Framework (A1 and A2) were correlated.

So, typically architects that make decisions quickly also validate their decisions quickly.

There were also correlations in the properties of the architects and projects. The size of the project seemed to correlate with many other properties: architecture experience ($p=0.015$), the duration of the project ($p=0.000047$) and the number of partners ($p=0.00054$). This means that larger projects typically run longer, with more partners and more experienced architects. Interestingly, there is no significant relationship between the size of the project and any of the success factors. However, the RoI ($p=0.047$) as well as the quality of the projects ($p=0.0095$) was higher in longer running projects. Also, longer running projects took more time to make decisions (A1, $p=0.030$).

Interestingly, development experience is an indicator for having a better quality in the project ($p=0.024$), while architecting experience is not.

6.5 Reflection

6.5.1 Threats to Validity

There are several threats to the validity of this research. First, this research is done based on a limited set of participants (39). But, as the researchers controlled the distribution of the questionnaire, the seriousness and expertise of the participants was confirmed. This makes the data from these participants of high quality.

When conducting a survey, the terminology used is very important. As the participant is not involved in a conversation with the researcher, there is no possibility to correct wrong interpretations. Especially when using terminology from the research community to interview industry practitioners, this can lead to misinterpretations. As both authors of this research have much experience in industry, we used the terminology familiar for the participants. However, in some cases we presume that interpretation can be causing the seen results. For example with the correlation between decision speed (A1) and decision validation speed (A2) can be caused by the usage of the term 'validation' in the context of decision making.

In this work, we have analyzed data to find correlation between specific parameters in the interviews. We do acknowledge that this correlation does not imply causality, as is the case in the beliefs we investigated. Often, the parameter that can be influenced, (e.g. the way in which a team does documentation), is seen as the cause, the property that is harder to influence (the RoI) is seen as the result. In our research, we investigated the believed relationships by assessing the correlation between the parameters involved. If no correlation is found, the causation direction is irrelevant (as with B1-3 and B6). The partial confirmation for B4 and B5 does not have a cause-effect 'direction', but is an indication that the belief can be confirmed.

6.5.2 Implications for practitioners

The architecture community holds many beliefs, of which we assessed six. Four of these beliefs have been busted, while the other two only have been partially

confirmed. Holding these unfounded beliefs has a severe economic, architectural and process impact.

For the decision speed, as belief B1 is held unwarranted, there is severe economic impact as the decision process is taking too long, while the quality does not suffer if decisions are made quicker (B2). Actually, the speed of making decisions does not effect the RoI or the quality of the decision, so the process focus should be limiting the effort spent on this, while continue looking for aspects that do effect the RoI or quality.

Considering the persons making the decisions, the impact of this research is that it does not really matter if the architects making the decisions actually code the system (B3). However, if you have more experiences architects, the RoI is positively affected (B4). This means, that the processes and roles used in organizations are irrelevant compared to the experience of the crew.

Last, the wrongly held beliefs about documenting architectural decisions also have a severe impact on the effort spent on system design. As having more documentation slows down the development speed (B5), while not adding anything to the quality of the product (B6), the economic implications are eminent. Considering the practices of architects, it is interesting to see that there is a lot of research about preserving architectural knowledge [23] by documenting it, while the benefits of this documentation is doubtful. This also affects the ways of working for architects: what is the use of prescribed documents like the SAD? What is the relevance of an architecture review process when this process is based on documents that don't help in a positive outcome of the project?

6.6 Related Work

In the architecture design decision research hierarchical structures are used to model architectural knowledge [23] or design decisions [100, 189]. This research often emphasizes the recording of architectural decisions or the extraction of these decisions later in the development process [186]. There has been much attention to documenting software architectures [42], as well as documentation templates [117] and Model Driven Architecture [146]. In the field of architectural knowledge, Poort et al. [153] conducted a survey to correlate project properties and architectural practices to project success. They focus on architectural knowledge sharing reasons, not the actual way in which architectural decisions are made (as analyzed by a position on the how-axis of the Triple-A Framework). They also don't find strong correlations between the used practices to the project success, but do conclude that the interpersonal relations have a strong effect on this success.

In the research on the success of software projects, Chow and Cao [40] assessed the success factors within agile projects by conducting a survey with agile professionals in the field. In this work, they compared several practices that affect the project to the perceived success of the project. No architectural related issues were identified, although one of the conclusions that the team capability effects the time and effort (cost) success factors can be related to our findings that the RoI is positively affected by having more experienced architects.

Somers and Nelson [170] assess a more traditional way of (ERP) software development. Interestingly, the most important Critical Success Factor mentioned in

this research for the initial stage of the project is the 'architectural choices'. However, there is no assessment of how these decisions should be made in this research.

6.7 Conclusions

All knowledge is founded on assumptions and beliefs. However, these beliefs change as new evidence is found. We have investigated the beliefs around architecture decision making, especially the beliefs that implied that the success of a project is highly dependent on the way in which the decisions are made; who makes the decisions, when are they made, how are they documented. We can conclude that our empirical evidence, based on the survey we conducted, cannot fund most of these beliefs. How quickly or slowly a decision is made does not effect the quality of the end-result. The architecting experience of the decision maker affects the RoI of a project, but the role of the decision maker or if the decision maker also codes the system is irrelevant. Documenting the architecture does not seem to affect the success of the project. Even stronger, using less documentation seems to speed up projects without losing quality.

Beliefs can help to have a common ground for discussions or plans. However, when these beliefs are not true, decisions are unfounded and projects can suffer. Especially the effort needed for discussions based on ungrounded beliefs can take a lot of time and effort. With this research, we hope to bury some of these debates by showing the subjected beliefs are busted.

Acknowledgements

We would like to thank all the participants of the survey for providing us with the their insights and data. Also, we would like to thank Viktor Clerc for his help with the initial questionnaire.

Appendix: Selection of the Survey Questions

TABLE 6.2: Project and Person Characteristics

Abbr.	Description	Question in the questionnaire	Multiple choice answers
P1	Architecting experience of respondent	Please indicate the number of years you have architecting experience.	'Less than 1 year' / 'Between 1 and 3 years' / 'Between 3 and 6 years' / 'Between 6 and 10 years' / 'More than 10 years'
P2	Developer experience of respondent	Please indicate the number of years you have experience as a software developer.	'Less than 1 year' / 'Between 1 and 3 years' / 'Between 3 and 6 years' / 'Between 6 and 10 years' / 'More than 10 years'
P3	Duration of project	How long has this project been ongoing?	'Less than 1 year' / 'Between 1 and 3 years' / 'Between 3 and 6 years' / 'Between 6 and 10 years' / 'More than 10 years'
P4	Team size in project	Please indicate the (average) size of the software development project team (architects, developers, business analysts, testers, DBA, project management, etc.).	'1 - 3 project members' / '4 - 8 project members' / '9 - 30 project members' / '31 - 100 project members' / 'More than 100 project members'
P5	Number of partners in project	Please indicate the number of different organizations or partners involved in the project.	<number>

TABLE 6.3: Success Factors

Abbr.	Description	Question in the questionnaire	Multiple choice answers
S1	Return on Investment	This decision increased the return on investment of the project.	Strongly disagree / Disagree / Neutral / Agree / Strongly agree
S2	Effort reduction	Because this decision was made, we needed to spend less effort on the project.	Strongly disagree / Disagree / Neutral / Agree / Strongly agree
S3	Development speed increase	The decision made the project finish more quickly.	Strongly disagree / Disagree / Neutral / Agree / Strongly agree
S4	Quality increase	The quality of the product was increased by the decision.	Strongly disagree / Disagree / Neutral / Agree / Strongly agree
S5	Performance	The performance of the system was positively affected by the decision.	Strongly disagree / Disagree / Neutral / Agree / Strongly agree
S6	Maintainability	The maintainability of the system was positively affected by the decision.	Strongly disagree / Disagree / Neutral / Agree / Strongly agree
S7	Security	The security of the system was positively affected by the decision.	Strongly disagree / Disagree / Neutral / Agree / Strongly agree
S8	Usability	The usability of the system was positively affected by the decision.	Strongly disagree / Disagree / Neutral / Agree / Strongly agree

TABLE 6.4: Triple-A Framework

Abbr.	Description	Question in the questionnaire	Multiple choice answers
A1	Periodicity of the making of the decision	What was the time between the moment the concern emerged and the moment the architectural decision was taken to address the concern?	'Within a day' / 'Between one day and one week' / 'Between one week and one month' / 'Between one month and half a year' / 'More than half a year'
A2	Periodicity of the validation of the decision	What was the time between the moment the architectural decision was taken and the moment the architectural decision was validated?	'Within a day' / 'Between one day and one week' / 'Between one week and one month' / 'Between one month and half a year' / 'More than half a year' / 'Not validated'
A3	The person making the decision	Who was the main decision maker?	'Development Team' / 'Application Architect' / 'Domain Architect' / 'Product Owner' / 'Enterprise Architect' / 'Management Project / Organization'
A4	Artifacts used to preserve the decision	How was this decision communicated?	'Direct communication to the stakeholders (real-life)' / 'Direct communication to the stakeholders (via phone / telco)' / 'Not explicitly documented; Notes, sketches and photos of whiteboards' / 'Documented without a template' / 'In a document, based on a template chosen for this decision' / 'In a document, based on a template that is mandatory in this project'

